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COMMITTEE FOR RENEWABLE ENERGY FOR BARRINGTON

Town of Barrington Wind Energy Project Economic Analysis

[January 6, 2009]

[Economic projection and analysis of the Barrington Wind Energy Project]

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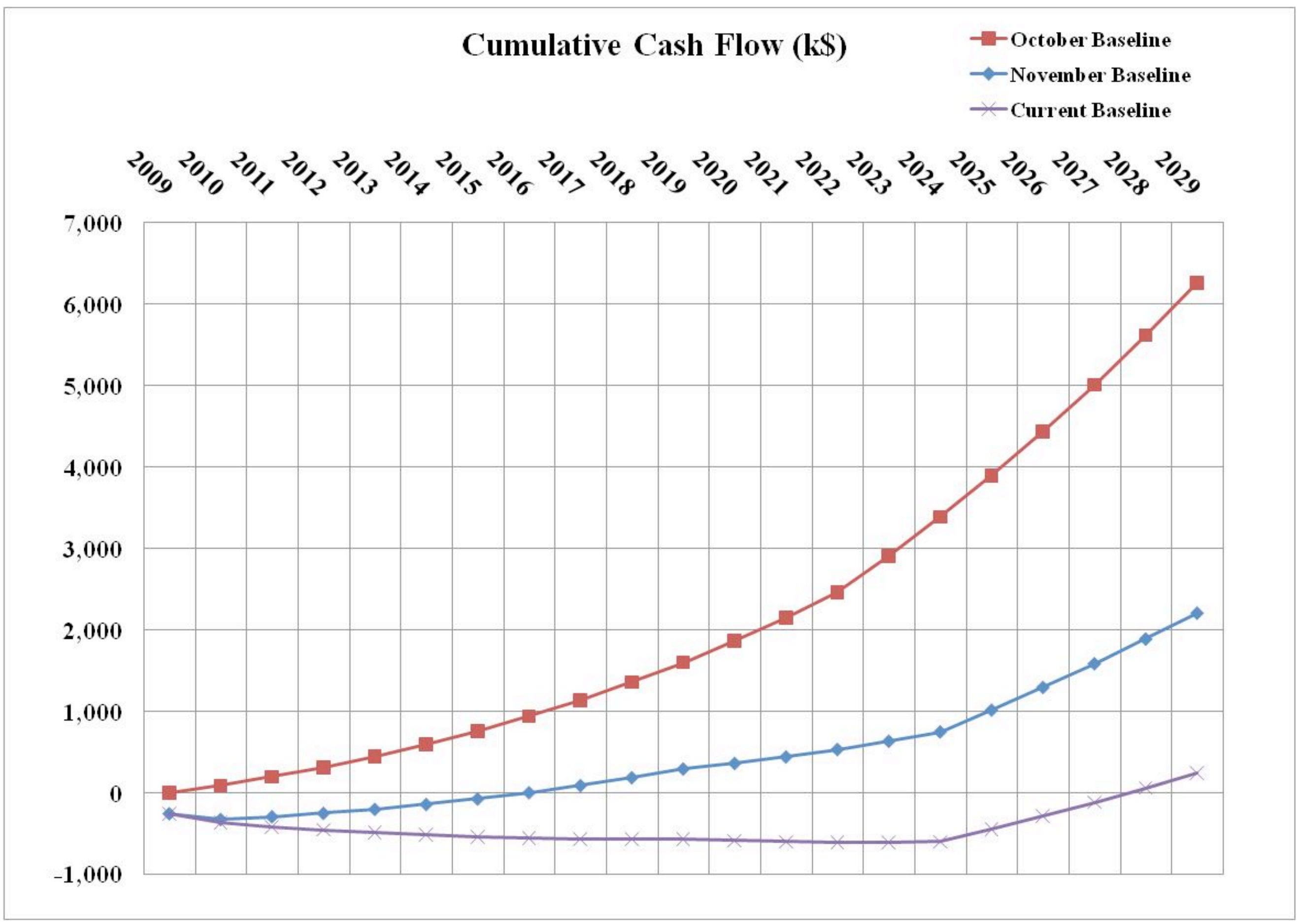
INTRODUCTION

This report is a summary of the economic analysis of the Town of Barrington Wind Energy Project (WEP) prepared by the Committee for Renewable Energy for Barrington (CREB). The analysis is performed using a cost model (Excel spreadsheet) of the key parameters over the life of the project. The original model was developed by Henry DuPont, the wind consultant for Exploratory Committee. Since several members of the CREB have experience with cost models, they expanded the model and used it to analyze many different conditions. The CREB used economic models of other wind turbine projects (e.g. Hull and Portsmouth) as examples to add more detail and refine the values of the input parameters. The structure and content of the model have evolved over many months as more data are collected and incorporated.

Over time, the economic benefit of the WEP has changed substantially due to political, economic and technical changes. As shown in the graph below, the economic benefit initially looked quite good, but with the latest changes, the economic viability is not there.



The major change from October to November was the projected reduction in electricity rates. The major change from November to the present was the projected reduction in energy produced from revised wind models.

INPUT PARAMETERS

There are many variables that influence the financial performance of the WEP, some well defined and others not well defined. The cost model is constructed to allow for the comparison of financial results for up to three sets of different input parameters. The report concentrates on the expected nominal values, but includes minimum and maximum expected values of key parameters to assess the sensitivity of the results. The input parameters to the cost model are listed below along with their current expected nominal value.

Clean Renewable Energy Bond	
Bond Financing (k$)	2,100.0
Amortization Period (years)	15
Placement Cost	1.00%
Turbine Acquisition Cost (k$)	2,210.9
Start-up Costs (k$)	145.0
Average Annual Energy Production	
Energy (Million kWh)	0.900
Year 1 Production (% of total year)	50%
National Grid Savings	
Year 1 Cost (¢/kWh)	12.0
Year 2 Cost (¢/kWh)	12.0
Annual Increase after Year 2	4.5%
Renewable Energy Credit	
Year 1 Credit (¢/kWh)	3.5
Annual Increase	0.0%
Years to End of REC	10
Insurance	
Year 1 Total Insurance (k$)	11.8
Annual Increase	3.0%
Maintenance	
Year 1 Cost (k$)	12.5
Annual Increase - Years 2 & 5	3.0%
Annual Increase - Years 5 - 10	5.0%
Annual Increase - Years 11 - 20	7.0%
Discount Rate	6.0%

In addition, the following general assumptions apply:

1. Turbine is 600 kW Elecon wind turbine sited at Legion Way, as proposed by Lumus.
2. Expected life of turbine is 20 years.
3. Stated years are fiscal years, ending June 30.
4. Bond proceeds are received by 6/30/2009
5. Turbine starts generating energy by 1/1/2010
6. Start-up costs include bond origination fees, consultant fees and contingencies (as required).
7. Insurance coverage includes liability, property & casualty.
8. Inflation rate of key cost drivers will likely be at different values.

9. Repayment of bonds is considered a cost
10. Bond proceeds offset turbine acquisition and other start-up costs; overage is treated as cost.

The following sections describe the cost model input parameters and give the rationale for the current expected nominal value along with a range of values for key parameters.

Clean Renewable Energy Bond Costs

The Town of Barrington has received approval to issue a Clean Renewable Energy Bond. The model assumes that bond financing of $2,100,000 will be received by July 2009. The town Finance Department has been in contact with the IRS about the details of bonds and provided inputs to the cost model. The bond placement expense of $20,000 is included in the start-up costs (below). The bond principal can be amortized in equal payments over 15 years. Although they are "zero interest bonds" there are expense charges that amount to about 1% of the outstanding balance of the bond.

Turbine Acquisition Cost

As stated in the Lumus proposal, total construction costs are $2,210,900 and are covered by a fixed price, turn key contract.[1]

Start-up Costs

The other start-up costs are estimated to be $145,000, based upon the following:

1. $20,000 for bond origination fees (estimate from town finance department). Bond origination fees refer to the legal fees necessary to issue the bond.

2. $15,000 for various consulting fees (based upon preliminary quotes from perspective consultants). Consulting fees are allocated for third party assessment of noise and environmental issues, as required, to be undertaken during the permitting and foundation building phase of the construction. These studies can help identify problems and allow for the development of mitigating strategies.

3. $110,000 for all other and contingencies (5% of acquisition cost). Contingencies refer to any unexpected costs not covered by the contract.

Average Annual Energy Production

Of course, a key parameter is the amount of energy that the wind turbine will produce. Since the wind is highly variable, the amount of energy from a wind turbine is typically expressed in terms of the average annual energy production – based upon the average annual wind speed. Early estimates of the average annual wind speed were on the order of 6.0 meters per second (about 13.4 mph) a with a resulting average annual energy production of 1,400,000 kWh. However, recent estimates from improved wind models are for an average annual wind speed on the order of 5.3 meters per second (about 11.9 mph) a with a resulting nominal average annual energy production of 900,000 kWh. The accuracy of the wind models is such that the expected range of average annual energy production varies from 688,000 to 1,136,000 kilowatt hours. This range represents the middle 80% of the probability distribution of average annual winds speeds for the site. The extremes on the high end (greater than 90%

probability) and low end (less than 10% probability) were not considered. This approach was taken to focus on the narrow, but likely, range of economic outcomes.

The cost model assumes that the wind turbine will be in full operation by January 2010 and would supply 50% of the normal average annual energy for that first fiscal year (ending June 30, 2010).

National Grid Savings

The largest "income" for the wind turbine is the savings realized by offsetting electricity costs from National Grid. The wind turbine is connected directly to the load (in this case, the sewer pumping station at Legion Way) "behind the meter" so that it meets the demand when it can. When the load demand is greater than what the turbine can supply, electricity is supplied FROM the Grid. When the load demand is less than what the turbine can supply, excess electricity is supplied TO the Grid. Electric meters measure the net flow. With current "virtual net metering" laws, municipalities are charged only for the net demand FROM the Grid they and get a credit for excess generation TO the Grid. The credit is dollar credit, at the National Grid rates, that can be a can be applied to other municipal accounts.

The following chart shows the current National Grid rate structure and the structure proposed for 2009. In general, a wind turbine will only offset the kWh charges from National Grid. The Demand Charges and Fixed Charges will still be there to cover the costs associated the peak demand and the administration of accounts. Only the shaded rates apply to the virtual net metering law; they apply to both the savings on the load account and the credit that can be applied to other accounts. [4], [5] & [6]

Monthly National Grid Charges (G-32 Rates)	Actual Rates as of 7/15/08	Proposed Rates as of 1/1/09	Comment
Electric Supply ($ per kWh)			
National Grid	$0.12400	$0.09500	
or Constellation NewEnergy	$0.10230	$0.10230	Barrington School Rate - thru 2010
or Constellation NewEnergy	$0.05963	$0.05963	Barrington Municipal Rate - thru 2008
or GEXA Energy	$0.09463	$0.09463	Barrington Municipal Rate - 2009 thru 2011
Other kWh Charges ($ per kWh)			
Transition Charge	$0.00322	$0.00235	
Transmission Adjustment Factor	$0.00541	$0.01064	
Distribution Charge	$0.00889	$0.00889	
Load Management Adjustment	$0.00230	$0.00230	
Demand Charges ($ per kW)			
Transmission Charge	$1.27	$1.27	
Distribution Charge	$2.00	$2.00	
Fixed Charges			
Customer Charge	$236.43	$236.43	
Gross Earnings Tax	4.167%	4.167%	Applied to all charges
Effective Net Metering Rate (less tax)	$0.14152	$0.11688	
Effective Net Metering Rate (with tax)	$0.14742	$0.12175	

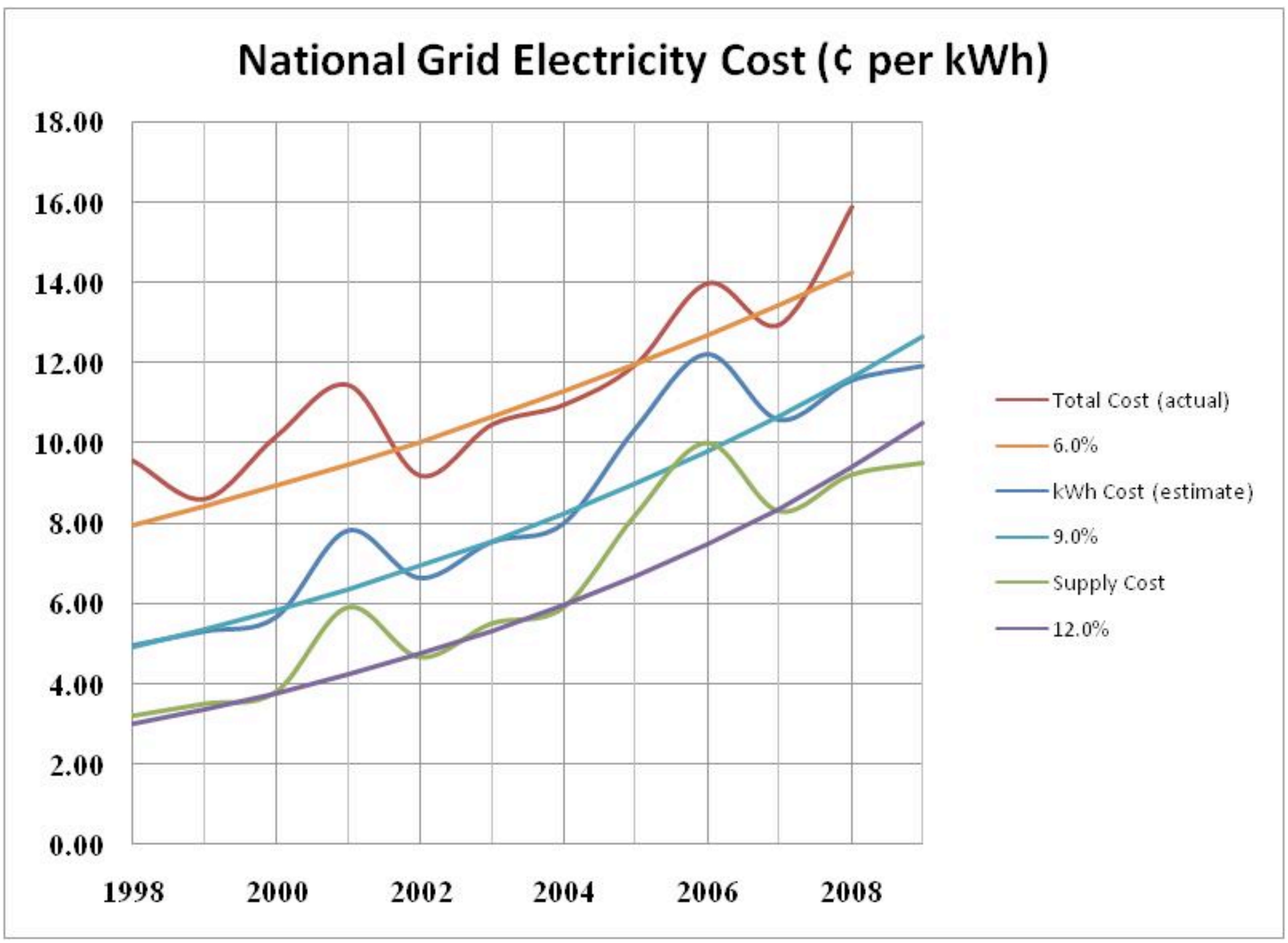
For 2009 and 2010, the cost model uses the expected rate of 12 cents per kilowatt hour.

Electric Rate Inflation

While nobody knows what the price of electricity will be in the future, there are plenty of estimates available on the Internet from which inflation rates can be derived. Synapse Energy Economics forecasts an inflation rate of 3.5% (0.5% over inflation) [7]. International Energy Agency in its World Energy Outlook 2008 [8] forecasts an energy rate increase of 5.5%.

However, history has shown that rates in Rhode Island do not necessarily follow national averages. There have been substantial differences in the cost of electricity across the nation. According to the US DOE Energy Information Administration, the average electricity rate in Rhode Island (all sectors) has consistently been among the highest in the nation. In general, it has been about twice the national average and nearly four times the rate in the energy producing states. According to the DOE, the total cost of RI electricity has increased an average of about 3% over the last 20 years, but the rate of increase over the last decade has been about 6%. [9]

As detailed in the previous section, there are essentially three levels of cost for electricity – electric supply charges, kilowatt hour charges and total charges. The following plot is of the history of cost at each of these three levels. The top plot is the total charges from the DOE; it has increased at about 6%. The bottom plot is the electric supply charges from National Grid [10]; it has increased at about 12%. The middle plot is the kilowatt hour charges based upon the current value and average inflation; it has increased at about 9%. The middle plot is the one most relevant to the wind turbine because the savings are based upon the kilowatt hour charges.



Based upon the above historical data, it is reasonable to assume that the kilowatt hour cost of electricity in RI will increase at a rate between 3% and 9%. A conservative value of 4.5% was selected as nominal. However, since the near term is highly uncertain, inflation is applied starting in 2012.

Renewable Energy Credit

The REC price is market driven with large energy suppliers being the primary buyers. They purchase the REC's to bring them into compliance with the RI Renewable Energy Standard.

The CREB has contacted Hull, Portsmouth Abbey and Portsmouth Wind Energy projects, Community Energy, Synapse Economics, and People's Power & Light, asking them about their opinions about the future direction of the REC market. Hull Wind 1 is currently in a 3 year contract for 4.5 cents/kWh which it expects to renew with Harvard University at that price for another 3 years. After that, Hull expects to receive 4.0 cents/kWh for 3 years followed by 3.5 cents/kWh for 5 years. Portsmouth Abbey recently sold their REC's in a 10 year contract for 3.5 cents/kWh.

The model assumes a constant REC price of 3.5 cents/kWh for 10 years (no inflation) and dropping to 0 thereafter. Currently there is more demand than supply and there are no indications that this condition will change over the next several years. There will be little incentive for the state legislature to eliminate the Renewable Energy Standard until there is an abundance of it and the incentive is not necessary or if the emphasis on renewable energy goes away. In fact, the conversation at the federal level of some sort of cap and trade system for carbon emissions could make the REC's or their equivalent more valuable.

Insurance

The town Finance Department has preliminary estimates for the cost of insurance. The wind turbine would require an addition of $5,000 to the Town liability insurance. The property and casualty (mechanical) insurance would be $6,800. Therefore, the model uses $11,800 per year at the start and an increase on 3% per year thereafter (assumed general rate of inflation).

Maintenance

The Lumus proposal includes quotes for five years of service starting at $12,500 the first year and increasing at a 3% rate in the following years. The CREB also obtained a copy of the operations & maintenance costs of Hull Wind 1, adjusted for inflation. Based on these inputs, the cost model uses the Lumus quote for the first 5 years, but then uses an inflation rate to 5% for years 5 through 10 and an inflation rate 7% thereafter.

Discount Rate

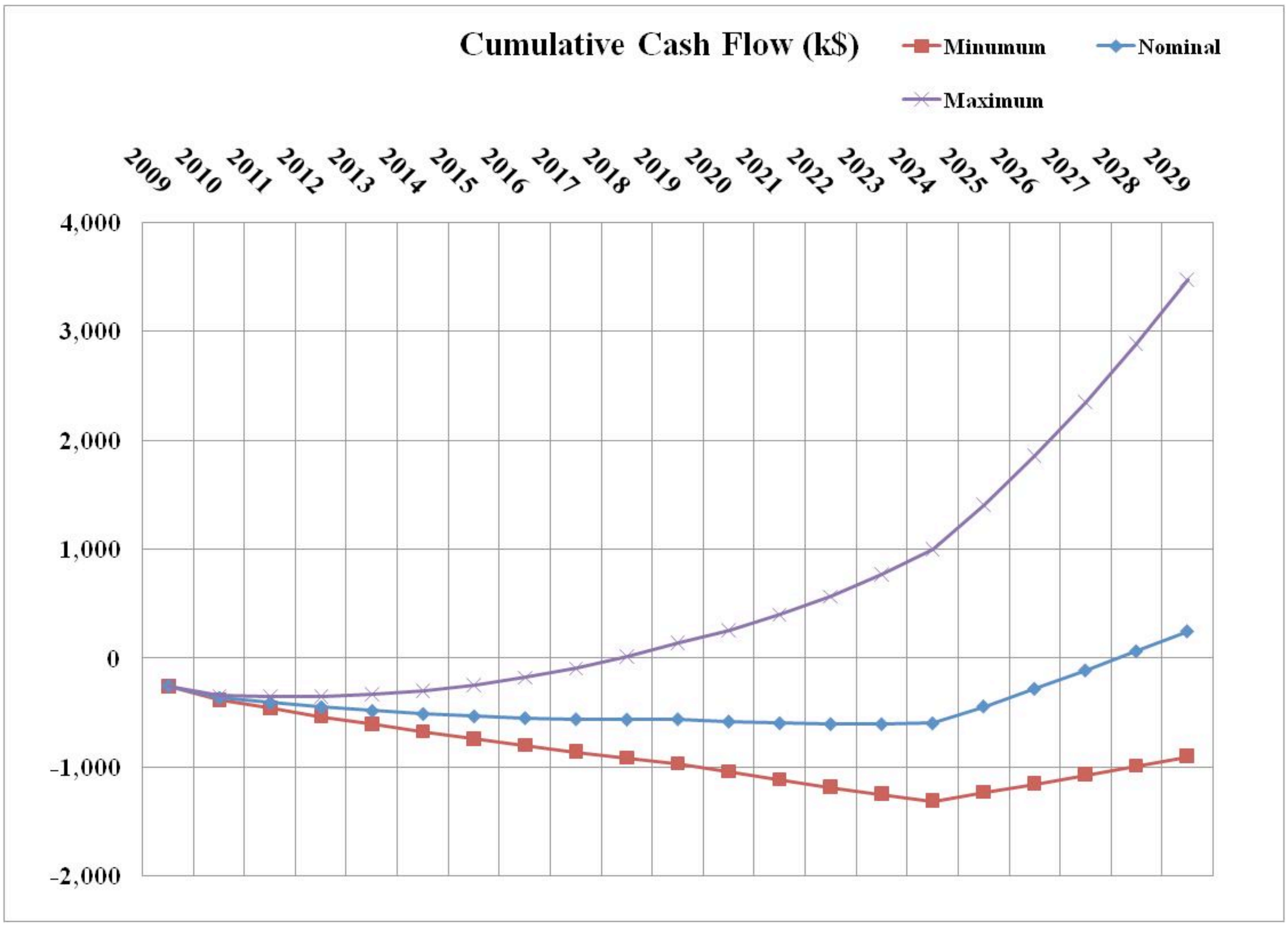
The discount rate used for Net Present Value is 6.0% (estimate from town Finance Department)

Turbine Life

A 20 year time horizon was used to reflect the minimum useful life of the turbine. 20 year life is consistent with all other cost models for projects that were reviewed by the CREB. There are wind turbines that have been operating since the mid 80s, suggesting that the useful life could be longer. Generally speaking, one expects that after 20 years technology will have improved to the point where it is more economical to replace an older turbine to take advantage of the wind resources. According to industry personnel, the cost to remove the wind turbine will be covered by the scrap value of the steel. There are isolated instances of catastrophic turbine malfunction resulting in a shorter lifespan; insurance should cover that possibility.

RESULTS

The cumulative cash flow generated over the 20 years will range from a loss of $904,500 using assumptions at the low end of their range (688,000 kWh energy production and 3% inflation) to a gain of $3,471,000 using assumptions at the high end (1,136,000 kWh energy production and 9% inflation). Using the nominal values for all the input parameters, the Wind Turbine Generator (WTG) will generate a total net savings of $244,000 over its useful life of 20 years but only achieve a positive cash flow after 15 years of operation. The following graph displays the minimum, nominal and maximum annual cash flow for the Wind Energy Project.



The net present value of the cash flows as plotted above are as follows:

Minimum $774,600 loss
Nominal $224,600 loss
Maximum $1,150,200 gain

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COST DRIVERS

The key cost drivers of the Wind Energy Project are:

1. Turbine acquisition cost
2. Average annual energy production
3. Prevailing cost of electricity
4. Inflation rate of electricity cost

SUMMARY

In summary, under current circumstances, the Wind Energy Project is not economically viable. However, when one or more of the above cost drivers improves substantially, the project should be revisited using the cost model.

REFERENCES

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[2] "RI Wind Power: Data for Preliminary Site Assessment" (http://204.17.79.245/website/windpower/viewer.htm)

[3] AWS Truewind Virtual Met Tower Report

[4] National Grid Rate Tariff 2008 https://www.nationalgridus.com/narragansett/non_html/rates_tariff.pdf

[5] Proposed National Grid Tariff 2009 http://www.ripuc.org/eventsactions/docket/4011-NGrid-AnnualReconciliation(11-14-08).pdf

[6] National Grid Tariff Advice Filing, Docket #3999 http://www.ripuc.org/eventsactions/docket/3999-NGrid--QFRate(10-29-08).pdf

[7] Synapse Energy Economics, "Avoided Energy Supply Costs in New England: 2007 Final Report," Prepared for Avoided-Energy-Supply-Component (AESC) Study Group, Jan 2008. http://www.synapse-energy.com/Downloads/SynapseReport.2007-08.AESC.Avoided-Energy-Supply-Costs-2007.07-019.pdf

[8] International Energy Agency, "World Energy Outlook 2008 Executive Summary", http://www.worldenergyoutlook.org/2008.asp

[9] Electric Power Annual Data Tables, EIA http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html

[10] National Grid Standard Offer Service Price History

https://www.nationalgridus.com/narragansett/non_html/hist_price-standard.pdf